UNIVERSITAT POLITÈCNICA DE CATALUNYA
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# BEKASI-EAST JAKARTA AIRPORT
## GROUND SIDE

**Report**

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# 1 Prognosis

## 1.1 Aviation context in Indonesia

Indonesia is the fourth most populated country in the world and the largest economy in south-east Asia. Indonesia is also, a growing touristic destination because its outstanding nature marvels and cultural monuments. It's topography which is composed by many island makes essential the domestic air transport.

Jakarta (located at the island of Java) is the centre of government, commerce and industry of Indonesia. Currently Jakarta has an international airport (Soekarno-Hatta International Airport). It operates around the 250% over its design capacity and an interesting fact is that last year 40% of its flights were delayed. Efforts have been made to decrease this problem opening a small military airport for civilian domestic flights. Nevertheless, the problem still persists.

The current Jakarta airport cannot be expanded, due to nearby neighbourhoods. "Some news have been recently published by Jakarta authorities confirming the urge of a new airport around Jakarta to absorb the saturated traffic of the Soekarno-Hatta International Airport, even after constructing a new runway and terminal on it.

All in all, it is essential to construct a new airport. Moreover, the secondary airport, really small, is only focused on military and private services and does not have enough fields at its surroundings to expand, as Jakarta air traffic requires.

### 1.1.1 Airport location

The main idea to find a good location was to put the new Jakarta airport in an area not too far from the city with enough space to build a big airport which has opportunities to expand in a further future.

Following this parameters, the location chosen geographically is situated to the east of the city

of Jakarta at 32 km from the city center. It is also located above the emerging city of Bekasi that in the last years is increasing its industry hosting several multinationals. In addition, the terrain is not edified yet and extensive, plus it is non-mountainous and obstacles-free.

Figure 1.1.1: Bekasi-East Jakarta Airport selected location.

It is a huge free obstacle flat field, without relevant slope gradients and the terrain is not edified yet. It is an exceptional location due to its huge amount of terrain available where companies could settle down taking advantage of the airport proximity, low terrain costs and direct connection with the down town. There is enough space to become also a logistic distribution centre of the island and Indonesia.

Finally, as it is an almost virgin land, communication is limited. Therefore, the solution is easy. The present Jakarta motorway will be extended. As it is shown on Fig. 1.1.1 indicated with a discontinuous line, there will be two connections between the current and the new highway.

Connection between airports will be achieved thanks to this new built highway. It will take 40min from door to door. Connection network of free-busses between both airports will make transfers safe and easy. There will be also available buses to and from the city centre, at low prices. During rush hours, a specific way will be delimited only for airport bus transfers.

### 1.1.2 Current traffic

The starting point has been Soekarno-Hatta Airport. As it can be seen on fig.1.1.2, currently Soekarno-Hatta Airport is handling volumes of passengers around 50 million passengers by year.

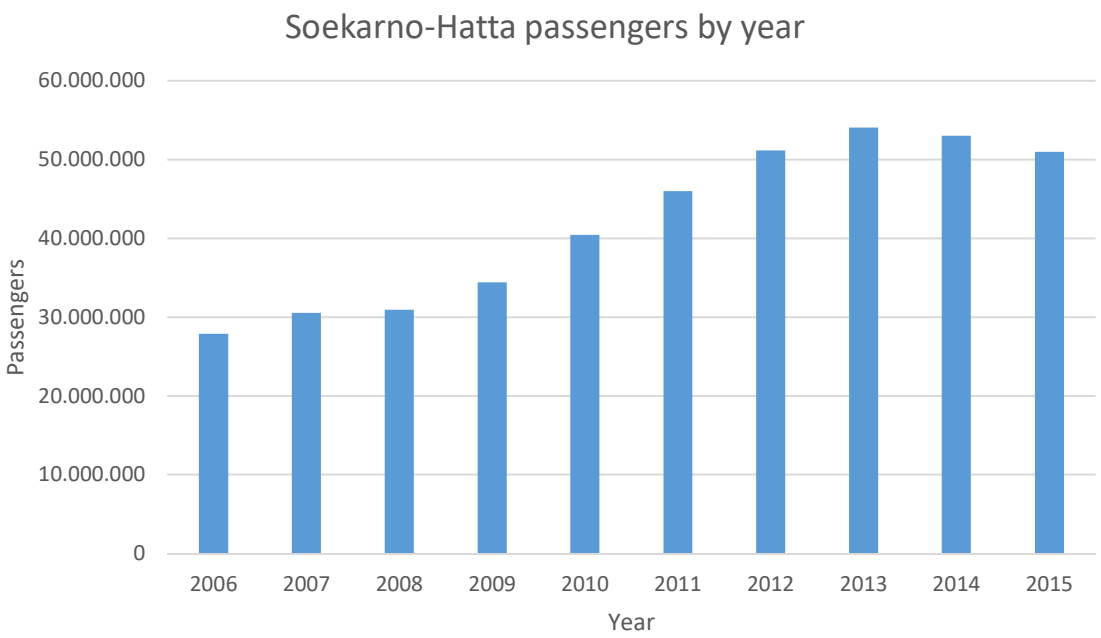


Figure 1.1.2: Soekarno-Hatta International Airport passengers by years

Operations on a mean day have the following pattern:

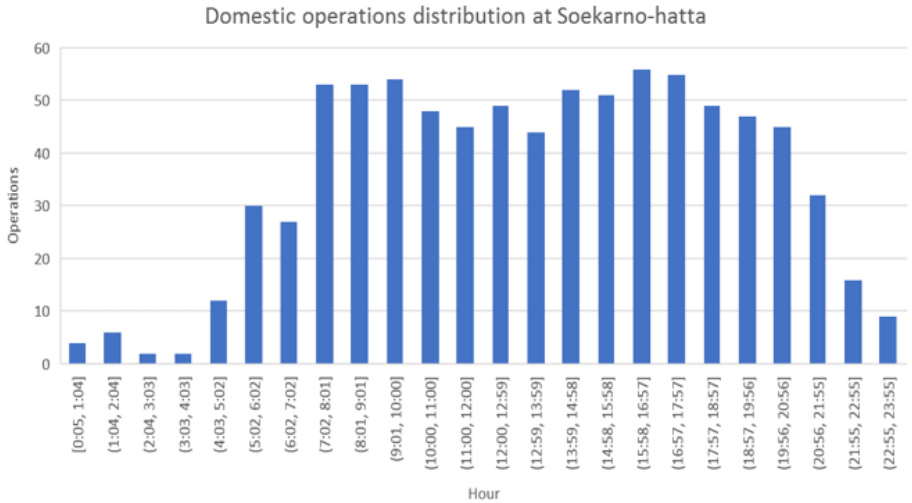


Figure 1.1.3: Soekarno-Hatta International Airport domestic flights distribution on busy day.

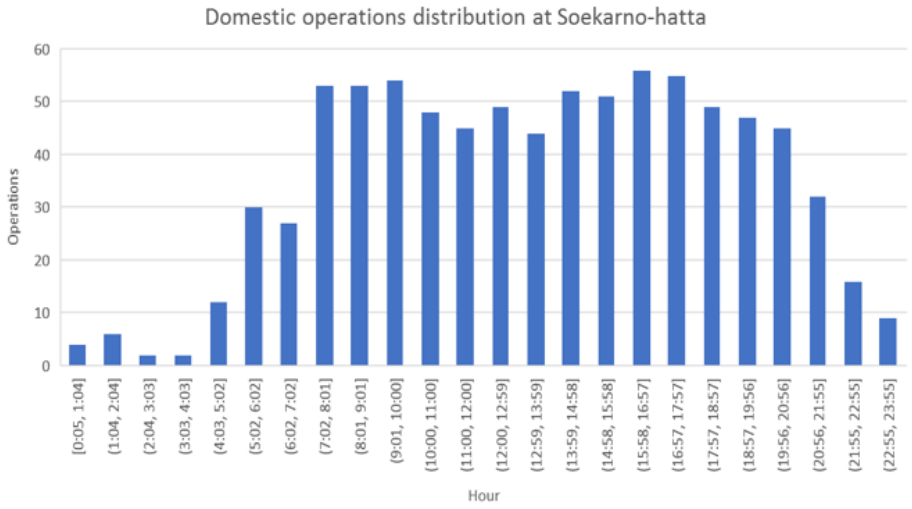


Figure 1.1.4: Soekarno-Hatta International Airport domestic flights distribution on busy day.

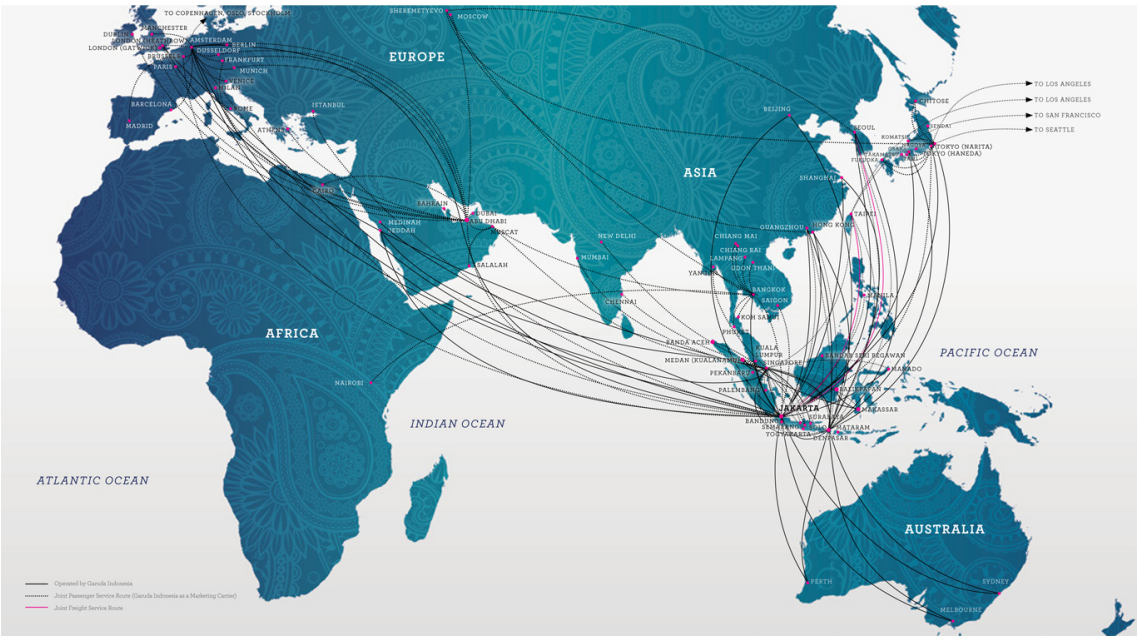


Figure 1.1.5: Soekarno-Hatta International Airport routes

### 1.1.3 Occupation factor

## 1.2 Reference aircraft

Hola

### 1.2.1 Aircraft type

### 1.2.2 Conclusions

## 1.3 Forecast computation

In order to do a realistic study for the new Bekasi-East airport traffic, it is previously established the Soekarno-Hatta International Airport (CGK) as the reference airport for future operations prevision. According to one of the IATA main recommended methods for the elaboration of traffic previsions, data from historical series of CGK traffic has been used so as to be able to extrapolate the study horizons of the airport to be designed.

In order to do this, it is necessary to calculate the annual variation tendency of the different traffic parameters from historical data of the last years. Data mentioned is extracted from the "Directorate General of Civil Aviation" (DGCA) and "FlightRadar24" web pages.

With this information, the next step is to calculate the values of horizon scenario, which has been fixed in 15 years with respect to the airport inauguration (it is expected to be finished in 2020). The horizon scenario will be fixed then in 2035.

Before starting the study of passenger and operation demands, some important aspects will be taken into account:

- The airport to be projected will absorb nearly the 40% of CGK's current traffic, which corresponds to the percentage of delayed flights due to congestion.
- The growth tendencies, concretely the Compound Annual Growth Rate (CAGR), has been calculated using the data corresponding to the five more recent years. The expression used to calculate the values is the following one:

$$CAGR = \left(\frac{V_{fin}}{V_{ini}}\right)^{\frac{1}{t_{fin}-t_{ini}}} - 1 \tag{1.3.1}$$

- The prediction of passengers and operations have been calculated using three possible scenario.
  - Neutral scenario: The growth is constant along time
  - Optimistic scenario: The growth is constant along time but in 2025 is multiplied by a factor of 1,5 due to, for example, a boom of tourism in the city.
  - Pessimistic scenario: The growth is constant along time but in 2025 is divided by a factor of 2 due to, for example, a period of time with adverse atmospheric phenomena.

In addition, both the airlines as well as the percentage of operations absorbed from CGK are detailed in the following table:

| AIRLINES | % OPERATIONS |
|---|---|
| **Garuda** | 31.62 |
| **Citilink** | 7.11 |
| **Emirates** | 0.35 |
| **Etihad** | 0.44 |
| **Qatar** | 0.53 |
| **Total** | 40.05 |

Table 1.3.1: Airlines absorbed and operation percentages from CGK.

### 1.3.1 Passenger prediction

In this section it will be calculated the number of annual passenger both domestic and international in the horizon scenario in 2035.

Taking into account the historical passenger data collected from CGK airport, one can obtain:

| Year | Domestic PAX | International PAX | Domestic OPS | International OPS |
|---|---|---|---|---|
| **2011** | 35.412.018 | 10.589.310 | 279.668 | 68.241 |
| **2012** | 39.499.760 | 11.674.136 | 327.416 | 79.288 |
| **2013** | 41.318.616 | 12.743.330 | 329.568 | 82.924 |
| **2014** | 40.531.384 | 12.489.680 | 331.120 | 115.184 |
| **2015** | 38.262.800 | 12.696.766 | 301.696 | 84.919 |

Table 1.3.2: Volume of passengers and operations of the last 5 years in CGK Airport.

The CAGR's calculated from data in the table above:

- CAGR for Neutral Scenario
- CAGR for Optimistic and Pessimistic Scenario (applied from 2025)

Using the growth taxes computed previously, it is obtained the following results in horizon scenario. It is important to remark that in the 5 last years period some fluctuations occurred in the passenger demand.

Plotting the results in a graphical form:

### 1.3.2 Operations prediction

In this section it will be calculated the number of annual operations both domestic and international in the horizon scenario in 2035.

Taking into account the historical operations data collected from CGK airport, one can obtain:

The CAGR's calculated from data in the table above:

- CAGR for Neutral Scenario
- CAGR for Optimistic and Pessimistic Scenario (applied from 2025)

Using the growth taxes computed previously, it is obtained the following results in horizon scenario. It is important to remark that in the 5 last years period some fluctuations occurred in the operations demand, as well as it occurred for the passengers. This fact seems intuitive since it is a very straight relation between number of passengers and operations.

Plotting the results in a graphical form:

### 1.3.3 Flights on busy day

IATA defines the busy day as the second busiest day in an average week during the peak month. An average weekly pattern of passenger traffic is calculated for that month. Peaks associated with special events such as religious festivals, trade fairs and conventions, and sport events, are excluded.

Having 2015 busy month values of passenger and operations for CGK airport and the total year values, the percentage of peak above mean can be calculated. Supposing this percentage above mean is conserved along time, it is easy to extrapolate the number of passenger and operations in busy day for the new Bekasi-East Airport. The following results are obtained:

With the number of maximum hourly operations and an utilisation factor of 77% for both domestic and international flights, the number of maximum passenger per hour in the airport is calculated.

# 2 Terminal building distribution

## 2.1 Basic dimensions of the terminal building

## 2.2 Surface distribution

The terminal building interiors will be distributed according to the FAA criteria. This method has been chosen because it differentiates between domestic and international passenger flows, which are very well defined at this airport.

In order to manage and distribute the space available, the forecasted traffic predicted in the prognosis is to be used.

In first place, as shown in table **??**, the surface corresponding to domestic traffic is distributed. According to prognosis data, the number of domestic passengers at design hour will be of 4850.

| Surface | % out of total | m2/pax | m2 total |
|---|---|---|---|
| **Departures** | 0.0435 | 0.609 | 2953.65 |
| **Arrivals** | 0.0435 | 0.609 | 2953.65 |
| **Waiting lobby** | 0.0739 | 1.035 | 5019.75 |
| **Restrooms** | 0.013 | 0.183 | 887.55 |
| **Kitchens** | 0.0652 | 0.913 | 4428.05 |
| **Restaurants** | 0.0652 | 0.913 | 4428.05 |
| **Offices** | 0.1957 | 2.739 | 13284.15 |
| **Other** | 0.0217 | 0.304 | 1474.4 |
| **Circulation** | 0.4783 | 6.696 | 32475.6 |
| **TOTAL** | | | **67904.85** |

Table 2.2.1: Estimated surfaces according to FAA (domestic flights).

In second place, as shown in table **??**, the surface corresponding to international traffic is distributed. According to prognosis data, the number of international passenger at design

hour will be of 3168.

| Surface | % out of total | m2/pax | m2 total |
|---|---|---|---|
| **Departures** | 0.0435 | 0.609 | 2953.65 |
| **Arrivals** | 0.0435 | 0.609 | 2953.65 |
| **Waiting lobby** | 0.0739 | 1.035 | 5019.75 |
| **Restrooms** | 0.013 | 0.183 | 887.55 |
| **Kitchens** | 0.0652 | 0.913 | 4428.05 |
| **Offices** | 0.1957 | 2.739 | 13284.15 |
| **Other** | 0.0217 | 0.304 | 1474.4 |
| **General circulation** | 0.307 | 6.145 | 19467.36 |
| **Immigration** | 0.042 | 0.838 | 2654.78 |
| **Customs** | 0.084 | 1.676 | 5309.57 |
| **Health** | 0.028 | 0.559 | 1770.91 |
| **Other checkpoints** | 0.006 | 0.112 | 354.816 |
| **Circulation** | 0.198 | 3.966 | 12564.28 |
| **TOTAL** | | | **63363.17** |

Table 2.2.2: Estimated surfaces according to FAA (international flights).

Nevertheless, due to our airport structure and preliminary design, some of these areas are going to be shared between domestic and international passengers. This will allow to tighten the space and reduce the extension of the terminal building, which will be too extense for the number of passengers at design hour.

Therefore, the final dimensioning of the airport will be as follows, shown in table **??**:

| General (shared) | m2 | Domestic | m2 | International | m2 |
|---|---|---|---|---|---|
| **Departures** | 4725.56 | **Waiting lobby** | 5019.75 | **Immigration** | 2654.78 |
| **Arrivals** | 4724.56 | **Circulation** | 32475.6 | **Customs** | 5309.57 |
| **Restaurants** | 7082.83 | | | **Health** | 1770.91 |
| **Offices** | 21248.50 | | | **Other checkpoints** | 354.81 |
| **Other** | 2358.27 | | | **Circulation** | 12562.3 |
| **Restrooms** | 1419.77 | | | **General circulation** | 19456.36 |
| **Kitchens** | 7082.83 | | | **Waiting lobby** | 3009.60 |
| **TOTAL** | **48641.34** | | **37495.35** | | **45131.33** |

Table 2.2.3: Total surface distribution of terminal building.

The total surface of the terminal building area, dedicated to passengers and airport management is of 131267 $\mathrm{m}^2$.

# 3 Structural typology description

## 3.1 Foundation

## 3.2 Vertical elements

## 3.3 Forge

# 4 Indoor paving

## 4.1 Typology

## 4.2 Floor covering

### 4.2.1 Structural base

### 4.2.2 Intermediate layers without buttress function

### 4.2.3 Leveling layer

### 4.2.4 Grip layer

## 4.3 Design

## 4.4 Superficial layer

### 4.4.1 Common areas paving

### 4.4.2 Stairways

### 4.4.3 Restroom paving

### 4.4.4 Offices paving

### 4.4.5 Automatic baggage handling system paving

# 5 Facade

## 5.1 Front and back facade

### 5.1.1 Requirements and adopted solution

### 5.1.2 Glass

### 5.1.3 Spider system with steel pillars

### 5.1.4 Steel and concrete mixed columns

## 5.2 Lateral facade

### 5.2.1 Facade (prefabricated concrete)

## 5.3 Other elements

### 5.3.1 Main door and other sliding doors

### 5.3.2 Access bridges

### 5.3.3 Emergency doors

### 5.3.4 Automatic baggage handling system doors

# 6 Building cover

## 6.1 Adopted solution

## 6.2 Shape and inclination of the building cover

## 6.3 Used materials

## 6.4 Sewer system

# 7 Indoor closures

## 7.1 Walls

## 7.2 Doors

### 7.2.1 Baggage claim hall doors

### 7.2.2 Office access and automatic baggage handling system access doors

# 8 Fire prevention regulations

## 8.1 Fire prevention regulations and chosen materials

### 8.1.1 Building elements

### 8.1.2 Materials

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